Environmental Labeling and Motivation Crowding-Out

Draft Interim Report

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The provision of information has in the last few decades become an important complement to, and even a means of, environmental regulation. There are a variety of information provision programs disseminating different types of information to different audiences. Voluntary environmental labeling or certification programs that provide information about the environmental characteristics of one or more aspects of a product's life cycle to consumers are among the most popular of these programs, having been widely adopted around the world in one form or another (USEPA, 1998, 1994, and 1993).

The United States has not missed this boat. Indeed, the U.S. Environmental Protection Agency (USEPA) and the U.S. Department of Energy (USDOE) were among the first governmental agencies in the world to adopt environmental information programs.[1] While the number of environmental information programs instituted by USEPA and USDOE has continued to grow, they have, for the most part, been limited to providing information on attributes that include not only a "public" benefit for the ambient environment but also a "private" benefit for the individual consumer. A specific example is provided by the ENERGY STAR® program, a rating program for electricity-using equipment and appliances, where increased energy efficiency translates into both reduced emissions from reduced energy demand (public benefit) and savings in electricity bills to the individual consumer (private benefit). This U.S. preference for labels with both public and private attributes is somewhat unusual, with many other nations having adopted programs that focus solely on environmental benefits.

One possible explanation for the difference in approach could be a concern that public benefits alone are not enough to motivate consumer behavior or, at least that labels will be more

[1] Legislation authorizing Energy Guide, pesticide labeling, and the Fuel Economy Information Program were enacted in 1975, while authority for toxic substances labeling was passed in 1976 (Russell, 2001).

effective if the public benefits associated with the label are supplemented with a reminder of associated private benefits. While neo-classical economic theory would seem to provide strong justification for such a concern, recent experimental and empirical results and advances in economic theory cast some doubt on this strategy. This project's work will largely be concerned with the specific challenge provided by the concept of "motivation crowding-out" (MCO), which posits that the presence of extrinsic rewards for a contemplated behavior (such as private benefits) may actually reduce an individual's intrinsic motivation to engage in that behavior (Frey, 1994). For example, Frey and Oberholzer-Gee (1997) found that offering to pay residents to accept a nuclear waste dump in their community reduced their stated willingness to accept the dump. If motivation crowding-out also applies to consumer labeling, then it may mean that labels with purely public attributes will be at least as effective as, if not more effective than, labels with both public and private attributes, as the private benefits may have a tendency to crowd-out the intrinsic motivation associated with the public benefits.

Thus, this research seeks to discover whether, in a controlled setting, consumer responses to different types of environmental labels do exhibit motivation crowding-out. The specific public benefits to be analyzed will be reductions in greenhouse gas emissions, while the private benefits will be energy cost savings. USEPA's ENERGY STAR labeling program will be used to signal the presence of both public and private benefits, while both USEPA's Green Power Partners program and a hypothetical "Energy Savings Manufacturer" program will be used to signal purely public benefits. The products to be analyzed will be refrigerator with various mixes of characteristics or attributes (subject to the outcomes of focus group analysis). Consumer responses to these different labels and to a variety of other product attributes will be collected through an online conjoint analysis (CA) exercise. More generally, this exercise will support an

examination of a variety of factors related to consumer responses to these environmental labeling programs.

The remainder of this report is organized as follows. The next section provides some background information on the relevant environmental labeling programs, primarily USEPA's ENERGY STAR and Green Power Partner programs. The objectives and policy relevance of the research are then discussed in more detail. Following this discussion is a broad overview of prior research on a variety of topics related to this research. This in turn leads to a detailed discussion of the economic model that underlies the CA instrument follows. The methods and procedures that will be employed to analyze consumer responses to environmental labels are then discussed. A concluding section offers some thoughts on the relevance of this research for environmental policy.

Policy Background

The ENERGY STAR program, established in 1992, is jointly administered by the Environmental Protection Agency and the Department of Energy. One of the program's activities is to certify those appliances that meet specified energy saving criteria more stringent than the minimum federal requirements. For example, refrigerators became eligible for the ENERGY STAR label in 1996, with ENERGY STAR qualified refrigerator models using at least 15% less energy than required by federal standards. The ENERGY STAR hurdle will be raised to 20% starting in 2008 (USEPA, 2007e). Since its introduction, the ENERGY STAR logo has become widely recognized, with public awareness now exceeding 65%. Further, the program would appear to be having an influence on consumers as survey results indicate that about 66% of the households who had knowingly purchased an ENERGY STAR product in the last six months pointed to the

ENERGY STAR certification as an influence in their purchase decision (USEPA, 2007a). Along the same lines, Banerjee and Solomon (2003) found that, among five popular U.S. eco-labeling programs (ENERGY STAR, Energy Guide, Green-e, Green Seal and Scientific Certification Systems), ENERGY STAR had the highest degree of market influence.

As pointed out earlier, ENERGY STAR products promise two benefits for consumers relative to conventional product models. First, by purchasing an ENERGY STAR certified model, as opposed to another model of a particular product, consumers may expect to save money on future energy purchases, though this is not stated explicitly on the label and no estimates of cost savings are provided.[2] Second, purchasers may perceive that there are public environmental benefits from reduced emissions associated with the avoided electricity use. Or, as ENERGY STAR materials have, at various times, put it "Money Isn't All You're Saving" and "Save Energy, Save Money, Protect the Environment."

The ENERGY STAR label is limited to the effect of the use of the labeled products on energy consumption and the program does not make any claims about the effects on energy consumption or the natural environment associated with the manufacture of the products. An EPA program established in 2001, the Green Power Partnership, does not consider the amount of energy used in manufacturing a product, but it does consider the share of that energy derived from renewable sources ("green power"). To qualify as either a Green Power Partner or a Green Power Leader, a certain percentage of the energy consumed by the firm must come from renewable sources, with the percentage being based on the firm's baseload, as shown in Table 1.

[2] For many appliances, consumers can also use the EnergyGuide label which provides information regarding energy consumption on a scale showing a range for similar models and the estimated yearly operating cost based on the national average cost of electricity.

Partners may buy any eligible green power, such as solar, wind, geothermal, biomass, biogas or low-impact hydro resources. Partnership status enables the firm to use a logo in their marketing and promotion materials that identifies it as a Green Power Partner and makes explicit the program's affiliation with EPA (USEPA, 2007c). The program now boasts more than 800 partners that are collectively buying more than 10 billion kilowatt-hours of renewable energy per year (USEPA, 2007c).

Table 1. Purchase Requirements for EPA's Green Power Partner Program.

Baseload or annual electricity use in kilowatt-hours	Percentage of baseload that must come from renewable sources to qualify as a:	
	Green Power Partner	Green Power Leader
≥ 100,000,001 kWh	2%	20%
10,000,001 – 100,000,000 kWh	3%	30%
1,000,001 – 10,000,000 kWh	6%	60%
≤ 1,000,000 kWh	10%	Not applicable

Source: USEPA (2007c).

The ENERGY STAR and Green Power Partnership programs are similar in that they both are related to reductions in GHG emissions, albeit in different ways, with ENERGY STAR promoting reductions from reduced energy consumption, while, the Green Power Partnership promotes the consumption of energy from renewable resources. There are also some important differences in the programs as well. While the ENERGY STAR program is concerned with specific products or even particular models of products, the Green Power Partnership is concerned with the environmental characteristics of a particular firm or other organization. An implication of this distinction is that the target audience of the ENERGY STAR program is relatively clear – consumers of the products included in the program. On the other hand, the target audience for the Green Power Partnership program is less clear, although it would certainly seem to include consumers. However, targeting the information provided by the Green Power Partnership to consumers of a particular product – as will be done in this exercise - will require some

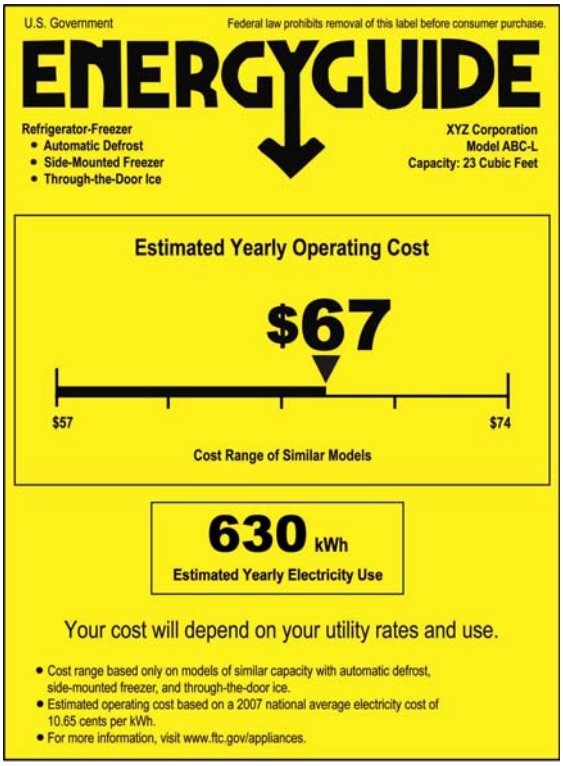
"interpretation" of the data. For example, making the programs comparable in terms of avoided emissions per unit of product will require that the Green Power Partnership program requirements be converted to a per unit basis. When placed in these equivalent terms, the Green Power Partnership will provide information on what is solely a public benefit to consumers of the product.[3] Also, the timing of these benefits differ, as the reduction in GHG emissions associated the Green Power Partnership all occur at the time of manufacture, while the reduction in emissions with the ENERGY STAR accrue over the lifetime of the product. All of these differences will need to be taken into account in designing the experiment to compare consumer responses to the two different programs.

Finally, information on projected energy consumption of appliances is provided to consumers in the U.S. through the EnergyGuide label. The U.S. Federal Trade Commission was tasked with developing a labeling program for home appliances and energy-using equipment by the Energy Policy and Conservation Act of 1975 and the National Energy Conservation Policy Act of 1979. The intent behind the EnergyGuide label, which was first implemented in 1980, was to improve energy efficiency and assist consumers in making purchase decisions via information provision (Egan, Payne and Thorne, 2000). Based on research performed by the U.S. Department of Energy, the EnergyGuide label shows estimated yearly operating costs for the particular model within a range of similar models and an estimate of the annual electrical consumption associated with the use of the product. A copy of the EnergyGuide label is shown in Figure 1.[4]

[3] The nature of the benefits to other potential recipients of the information likely varies among these different recipients. For example, investors may perceive firms that are Green Power Partners to be good investments because they are likely to face reduced costs in the future as individuals might be more interested in working at such a firm, etc.

[4] The Federal Trade Commission is currently in the process of altering the EnergyGuide label slightly pursuant to 16 C.F.R. Part 305: Appliance Labeling Rule: Notice of Final Amendments To The Appliance Labeling Rule Concerning Disclosures Regarding Energy Consumption and Water Use of Certain Home Appliances and Other Products Required Under The Energy Policy And Conservation Act. The description and image shown here are of the revised label.

Figure 1. EnergyGuide Label



Study Objectives and Relevance

The purpose of this study is to analyze the influence of extrinsic (energy cost savings) and intrinsic rewards (helping the environment) on willingness to pay for consumer products, with a particular focus on testing for the presence of motivation crowding-out (MCO) in these responses. Whether or not consumer responses to environmental label are influenced by MCO is of interest because of the important implications that it can have for the design and marketing of environmental labeling programs. For example, should environmental labeling efforts be limited to, or at least concentrated on, those instances in which there are clear public and private benefits associated with the label or should these efforts include instances where the benefits are more purely public in nature? Similarly, can the presence or absence of MCO inform efforts to market those programs that relate to both public and private benefits, such as ENERGY STAR? What are

the likely effects on consumers of emphasizing the combination of public and private benefits from such a program?

The study design will insure that the results will be relevant for evaluating the efficacy of consumer labeling programs, in general, and specific label structures in particular. Some specific questions to be addressed in the study are:

- Does the provision of information about attributes with purely public dimensions have an effect on consumption decisions?
- How do demographic or attitudinal characteristics influence the consumption decision when purely public dimensions are presented?
- What effect does pointing out both the public and private dimensions have on consumption decisions? Is the effect to elicit a greater or lesser response from consumers than a purely public label?
- How do demographic or attitudinal characteristics influence the stated consumption decisions in the presence of label information?

Prior Research

Environmental Labeling or Certification Programs

A variety of programs have been implemented by governmental and non-governmental organizations with the intent of disseminating information about the environmental "attributes" of companies or products.[5] These programs run the gamut from highly-technical, plant-level data about toxic releases to simplistic labels meant to symbolize the environmental "worthiness" of a particular company or product Audiences for the programs include consumers, investors, voters,

[5] For a more detailed overview of programs designed to disseminate environmental information on products and companies than presented here, see Russell, Krarup and Clark (2005), Tietenberg (1998), and USEPA (1993).

neighbors, and local public health and safety officials. The nature of the information provided ranges from raw, technical data, to information that has been distilled into some form of label, grade or certification. The most popular of these programs are the eco-labeling or environmental certification programs that disseminate distilled information about individual products to consumers.[6] These programs typically award the use of a logo to those products or models judged to be less environmentally harmful than comparable products or models, based on a specified set of award criteria (USEPA, 1993).

In general, the provision of environmental information has been shown to "work" in the sense that publicly provided information seems to have influenced some private decisions, which, in turn, has arguably changed environmental practices. This evidence has been most highly developed in the case of a program providing information on individual manufacturing facilities or plants - the U.S. Toxics Release Inventory (e.g., Hamilton, 1995; Hart and Gautum, 1996; Khanna, *et al.*, 1998; Konar and Cohen, 2001; and Konar and Cohen, 1997). However, there is also evidence that environmental labels have prompted changes in consumer behavior. For example, using Danish consumer diary data, Bjørner, *et al,* found statistically significant levels of consumer choice of more expensive, eco-labeled laundry detergents and toilet paper brands (Bjørner *et al*, 2004). Other examples include studies of environmental labels for a variety of products, including electricity (Roe, Teisl, Levy, and Russell, 2001; Roe, Teisl, Rong and Levy, 2001), apparel (Nimon and Beghin, 1999a; Nimon and Beghin, 1999b), food (Grankvist and Biel, 2007; Teisl et al., 2002), wood products (Anderson and Hansen, 2004a, 2004b) and

[6] Prominent examples of environmental certification programs include the European Union's Ecolabel, Germany's Blue Angel, and the Nordic Council's White Swan.

laundry detergents (Henion, 1972).[7] In addition, there are a large number of studies finding that a significant proportion of survey respondents are at least willing to state a willingness to pay a premium for an environmentally labeled product (e.g., Aguilar and Vlosky, 2007; Blend and van Ravenswaay, 1999; Cason and Gangadharan, 2002; Ethier et al., 2000; Grankvist, Dahlstrand, and Biel, 2004; Jensen et al., 2004; Jensen et al, 2003; Johnston et al., 2001; Loureiro, McCluskey, and Mittelhammer, 2002; Moon et al., 2002; Loureiro and Lotade, 2005; O'Brien and Teisl, 2004; Ozanne and Vlosky, 2003; Ozanne and Vlosky, 1997; Veisten, 2007; and Wessells et al., 1999). In addition, there are also a number of papers that examine various aspects of environmental labeling schemes and characteristics (e.g., Kane, *et al.*, 2000; OECD, 1997; Teisl and Roe, 2005; Teisl and Roe, 1998; and USEPA, 1994).

Energy Efficiency and Green Power Labeling

The energy crisis of the 1970's led to widespread recognition of the need to promote energy conservation and efficiency (Crossley, 1983; Frieden and Baker, 1983). Increasing recognition of potential improvements in energy efficiency coupled with the belief that higher energy prices improved the economic rationale for consumer investment in energy saving measures, led many commentators to call for programs to increase awareness of the private benefits of conservation, providing consumers with encouragement to conserve energy. Consumers were also strongly in favor of some form of energy labeling (e.g., Anderson and Claxton, 1979; Bennett and Moore, 1981, Consumer Association, 1978). These sentiments led to the introduction of the EnergyGuide label for appliances in 1980 and a dramatic increase in research on energy conservation (McDougall, et al. 1981; Ritchie and McDougall, 1985),

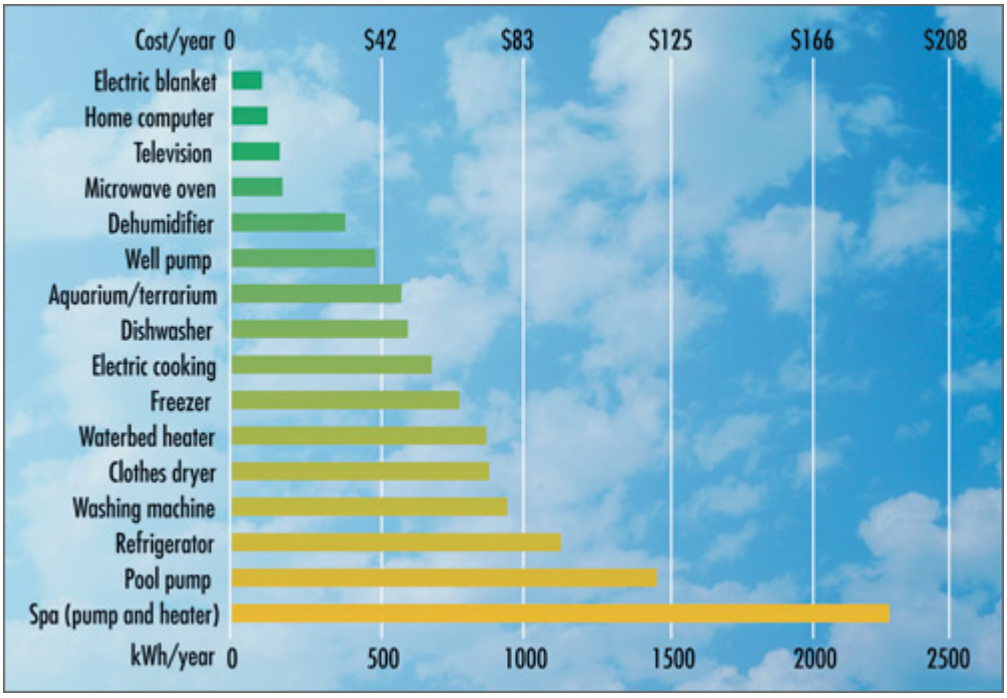
[7] There are other studies analyzing programs that simultaneously convey information on both public and private product attributes, such as organic food (environment and health) and energy-conserving appliances (environment and expense).

including an extensive literature on factors relevant to a variety of energy conserving behaviors, such as changes in behavior patterns, investments in energy saving technologies and the incorporation of energy consumption characteristics into consumer decision-making regarding appliance purchases (e.g., Dubin and McFadden, 1984; Gately, 1980; Hausman, 1979). In general, the results of this research can be characterized as disappointing, in the sense that participation in energy conserving behaviors seemed lower than might have been expected. Indeed, the difference between those investments in energy efficiency that appear to be in the consumer's own interest and those that consumer actually make has become known as the "efficiency gap" (Golove and Eto, 1996). As a result, research focus turned to trying to understand the barriers to increased energy conservation (e.g., Anderson and Claxton, 1982; Crossley, 1983; DeCanio, 1998; Frieden and Baker, 1983; Golove and Eto, 1996; Hassett and Metcalf, 1996; Hassett and Metcalf, 1993; Hirst and Brown, 1990; Howarth and Anderson, 1993; Komor and Wiggins, 1988; Koomey and Sanstad, 1994; Reddy, 1991). Given the time dimension involved in the benefits (cost savings) of an investment in energy saving technology or an energy efficient appliance, much of this literature has focused on the apparently high discount rates displayed by consumers in foregoing these investments or purchases (e.g., Kooreman, 1996; Kooreman, 1995; Kooreman and Steerneman, 1998; Meier and Whitaker, 1983; Sanstad, Blumstein and Stoft, 1995; Thompson, 1997; Thompson, 2002; and Train, 1985).

An important part of these research efforts has focused on the effects of the EnergyGuide label and similar programs that provide consumer information on the estimated energy consumption of appliance models (e.g., Anderson and Claxton, 1982; BPA, 1988; Chestnut, 1976; Dyer and Maronick, 1988; Egan, Payne and Thorne, 2000; GAO, 1993; Redinger and Staelin, 1980; USEPA, 1989; Verplanken and Weenig, 1993; and Worrall, 1976;). One particular

product that has received considerable attention is the refrigerator, likely due in large part to its high relative use of energy. See Figure 2. For example, Moxnes (2004) estimated the effects of energy efficiency standards for refrigerators on customer utility by using conjoint analysis. The results from that study suggested that only standards below 209 kWh per year would result in a reduction in utility. The study found that if only the most efficient refrigerators were allowed on the market, the average customer utility would be reduced by 7%. Greening, Sandstad, and McMahon (1997) considered multiple characteristics in an hedonic study of refrigerator prices, including food compartment volume, freezer compartment volume, annual energy usage, type of outlet purchased from, wire or glass shelves, factory installed ice maker, configuration of refrigerator (for example side-by-side), and region of purchase. Their results did not demonstrate a strong price effect for energy efficiency. Other studies that have investigated consumer inclusion of energy consumption as a factor in evaluating refrigerators include: Anderson and Claxton, 1982; BPA, 1988; Claxton and Anderson, 1980; Meier and Whitaker, 1983; McNeil and Wilkie, 1979; Redinger and Staelin, 1980; Verplanken and Weenig, 1993; and Worrall, 1976.

Figure 2. Energy Consumption of Various Home Appliances



Source: U.S. Department of Energy, Energy Efficiency and Renewable Energy, http://www1.eere.energy.gov/consumer/tips/appliances.html.

More recently, researchers have turned their attention to evaluating the ENERGY STAR program (e.g., Bannerjee and Solomon, 2003; Brown, Webber and Koomey, 2002; Geller, et al. 2006; Golberg, Goepfirch and Spielman, 2005; Horowitz, 2001; Howarth, Haddad, and Paton, 2000; Webber, Brown and Koomey, 2000; USEPA, 2007b). These studies suggest that the program is achieving widespread recognition and generating substantial energy savings. For example, Brown, Webber, and Koomey (2002) projected that by 2010 annual carbon emissions would be reduced by 20 million metric tons (44.2 billion pounds, or about 0.8%) as a result of the ENERGY STAR program.

There are also a number of analyses of consumer perceptions of the provision of energy from renewable sources ("green power") (e.g., Byrnes, Jones and Goodman, 1999; Clark, Kotchen, and Moore, 2003; Farhar and Houston, 1996; Harmon and Starrs, 2004; Holt and Wiser, 1999; Kotchen and Moore, 2004; Kotchen and Moore, 2007; Roe, Teisl, Levy, and

Russell, 2001; Rowlands, Scott and Parker, 2003; Rowlands, Parker and Scott, 2002; Whitehead and Cherry, 2007; Wiser, Bolinger, and Holt, 2000; Zarnikau, 2003). The results have suggested a positive willingness to pay for green power, and several of these studies have revealed a preference for solar and wind over other types of renewable energy. On the other hand, actual participation in green power programs is quite low. For example, in 2005, the average participation rate in utility green pricing programs was about 1.5% (Bird and Swezey, 2006).

Several of the above studies examined the effects of demographics and behaviors on preferences for green power. The findings include:

- that education has positive impacts on consumer preferences (Roe, Teisl, Levy, and Russell, 2001; Rowlands, Scott, and Parker, 2003; Zarnikau, 2003);
- that income plays a positive role (Clark, Kotchen, and Moore, 2003; Kotchen and Moore, 2004; Roe,Teisl, Levy, and Russell, 2001; Rowlands, Scott, and Parker, 2003; Whitehead and Cherry, 2007; Zarnikau, 2003); and
- that environmental behaviors, such as membership in environmental organization, or environmental concerns have a positive influence (Kotchen and Moore, 2004; Roe, Teisl, Levy, and Russell, 2001; Rowlands, Scott, and Parker, 2003).

In addition, Wiser, Fowlie, and Holt (2001) examined the non-residential demand for green power, including that by businesses. Their results suggested that organizational values and civic responsibility were more important motivators than perceived green marketing in the decision to make green power purchases. Thus, only about 10 percent of the respondents had used the fact that they purchased green power in their point-of-sale marketing. The top 25 participants in the Green Power Partnership, which account for about 60% of the green power commitments by Green Power Partners, use about 6.24 billion kWh of green power. This is

about 6.6% of net generation of non-hydro renewable electricity (95 billion kWh in 2005) and less than 1% of total net electrical generation.

Zarnikau (2003) found that while gender had no significant effect on willingness to pay for greater energy efficiency, salary and education level had positive influences. Poortinga, Steg, Vlek, and Wiersma (2003) examined household preferences for energy saving measures. People with high environmental concern evaluated the energy-saving measures on average as more acceptable than did people with low environmental concern. Energy saving measures in the home were relatively more acceptable to respondents aged 20 through 39 years, than to those 65 years and older. Couples and families found home energy saving measures relatively more acceptable than singles did. Home measures were also relatively more acceptable to respondents with high and average incomes than for respondents with low incomes.

Similarly, Noblet, Teisl and Rubin (2006) investigate the effects of demographics and environmental attitudes on vehicle selection. Their results suggest that eco-information has an influence on consumers who are selecting vehicles within a class (for example among cars, among SUV's, or among trucks), but not on consumer choice of a particular class. This study also found that if individuals believe their purchase habits may be effective in addressing environmental issues and if they have concerns about air quality, they will be more likely to respond to a label promising positive environmental effects.

Prosocial Behavior and Motivation Crowding-Out

Much of the research on energy labeling and energy conservation has focused on the potential cost savings to consumers. However, for many other types of pro-environmental behaviors (e.g., recycling) and for many other types of labeling programs there are no private

benefits such as cost savings for the actor. When attempting to explain why a consumer might prefer a more expensive "green" variety of a good to a less expensive "brown" (but otherwise identical) variety, neo-classical economists often rely on the tautology that if consumers choose the green variety it must be because they have a preference for green products. Psychologists, on the other hand, have expended a great deal of effort in analyzing the motivation for this type of behavior, i.e., undertaking an action with costs, but no readily apparent benefit to the individual. As a result, they have distinguished between two different types of motivation - intrinsic and extrinsic. An intrinsically motivated action is one done solely for the sake of doing it, or where the motivation comes from within the actor herself. An extrinsically motivated action, on the other hand, is an action performed in response to an external stimulus, or where the motivation comes from somewhere other than the actor (Deci, 1971).

Since much of economic theory starts with the assumed ability of extrinsic motivation to affect behavior, economists have, in general, tended to accept these assumptions without much thought. Psychologists, on the other hand, have long questioned the independence of intrinsic and extrinsic motivation, and there is a well-established body of literature asserting that the presence of extrinsic rewards actually has an adverse affect on intrinsic motivation.[8] Psychologists refer to this effect as the "hidden costs of reward."[9] This concept has recently seeped into the economics literature, where it has been termed motivation crowding-out (MCO),

[8] For an idea of the breadth of the experimental evidence for this effect, see the meta-analysis of 128 different laboratory experiments investigating the effects of a wide variety of extrinsic rewards on intrinsic motivation in Deci, et al, 1999.

[9] "Social psychologists have argued that there are "hidden costs of reward" (Lepper and Greene, 1978), and that monetary rewards may reduce intrinsic motivation (surveys are given in Deci and Ryan, 1985; Lane, 1991). From a rational choice point of view, this reduction of intrinsically motivated activities is straightforward (Frey, 1994): If a person derives intrinsic benefits simply by behaving in an altruistic manner or by living up to her civic duty, paying her for this service reduces her option of indulging in altruistic feelings. Her intrinsic motivation then has a reduced effect on supply." Frey and Oberholzer-Gee, 1997: pp. 746-7.

to illustrate the idea that the presence of extrinsic rewards may reduce or "crowd-out" intrinsic motivation.

In fact, MCO is one of a growing list of behaviors that hard-core micro economists label "non standard", in that they appear to contradict the core assumptions, or the resulting theorems, of the neo classical model of the rational economic actor. What makes MCO especially interesting is that it involves a response to the introduction of economic incentives, designed to encourage prosocial (or otherwise desirable but not "rational" in the narrow sense) behavior that is itself "non standard", such that the incentives in fact discourage the behavior. The earliest example, and the one that has become classic, comes from the world of voluntary actions that make other people better off but have no obvious payoff for the actor…the donation of blood. The observation is that the amount of blood donated is reduced by the introduction of payments to those who donate. (See, for example, Titmuss, 1970, Upton, 1973.) Two questions that probe the standard model are thus raised: (1) Why would a person give blood voluntarily for a zero reward? And (2) Why would this action be discouraged by increasing the reward above zero?

That MCO is a real phenomenon seems beyond question. It has been documented and studied for five decades by psychologists and economists and has been discovered via field work and lab experiments in situations as diverse as the design of work place monitoring and reward systems, the provision of money rewards for performing (or fines for failing to perform) civic duties such as voting, and the introduction of payments for the performance of what had been a voluntary charity solicitation task. (See the review by Frey and Jegen, 2001.) In addition to field based results, laboratory behavioral experiments have been done in sufficient quantity to justify meta analyses. Frey and Jegen characterize that done by Deci, et al., 1999 as the "best available

survey"…p. 597. It concludes that the experiments support the existence of the MCO phenomenon.[10]

To come to grips with MCO, it is, therefore, first necessary to gain some understanding of why individuals choose to behave in prosocial ways in the first place. That is, why do people vote; give blood; donate large amounts of money to a huge number of charities covering the good-cause waterfront from art, through education and historic preservation to public broadcasting and wildlife protection? The tangible results from such efforts are in the nature of public good, which the donor can expect to enjoy whether or not s/he contributes, so the strict rational model suggest that free riding will be the standard behavior. Meier (2006) provides a clear and comprehensive survey of the major contenders for recognition as explanations of such behavior. He groups these motivations under three broad headings: (1) those that depend on the expected outcomes of contributing time or effort or money, as in the varieties of altruistic concern for the welfare of others or aversion to inequality per se; (2) those that reflect the actions of others in a sort of social game of reciprocal cooperation; and (3) those that involve the definition of self through actions, both private and public. One is tempted, at least as an economist, to suggest that the third category may actually lie behind the other two. This temptation is encouraged by the definition of one variety of altruism, called "impure" (Andreoni, 1990), in which the prosocial actor receives a private "warm glow" from taking the action, rather than from any outcome or any interaction with others. It is not much of a stretch to see that glow as the radiation from an enhanced self-image. It is also easy to see that self-image and external

[10] Even so, it may be wise to maintain some skepticism of behavioral laboratory evidence involving student subjects and very modest rewards. In the 1980s a nonstandard behavior that was of considerable interest, "preference reversal", was demonstrated regularly by such experiments (for example, Grether and Plott, 1979, Slovic and Lichtenstein, 1983, and Tversky, Slovic and Kahneman, 1990). When Bohm, in the 1990s, designed and carried out an experiment in which the potential gains from acting rationally were substantial, however, the behavior disappeared (Bohm, 1994; Bohm and Lind, 1994).

reputation must be loosely linked, though of course not identical. Certainly most of us prefer to be thought well of to the opposite condition. And being thought well of, while not guaranteeing that we feel good about ourselves, is very likely to encourage that state of mind. So pursuit of self image may well involve at various times and in various situations concern about how, and indeed whether, our actions are perceived by others.

It is in this context of self and public image construction that Bénabou and Tirole (2006) have crafted a model that can give rise to MCO and have explored its implications. At the heart of the model is the matter of signaling, through your actions, to oneself or to others, what sort of person you intend to be. The signals consist, on the one hand, of pure prosocial action…the purchase of a public good; and on the other, the acceptance of a tangible, private reward for taking the action. The first indicates to yourself or to observers that you are likely to be a public-spirited, generous sort of person. The second suggests that you may also (or alternatively, depending perhaps on the scale of the reward) be a typically selfish economic actor. This complex decision setting can give rise to MCO because the presence of the private reward potentially distorts the signal you would like to send yourself or others and therefore makes the choice of the prosocial action less useful as an image or reputation enhancer.

Economic Model

We employ a lightly revised version of the model proposed in Bénabou and Tirole (2006) to motivate our empirical analysis. This model was chosen because it allows us to model individual choice over whether to participate in a prosocial activity taking into account a mix of three different possible sources of motivation – intrinsic, extrinsic and reputational. In this case, the prosocial activity is the choice of a variety of a good that has some positive social

connotation over another variety. Thus, choosing the more energy-efficient of two different varieties of an appliance implies a "contribution to the public good" in the sense that it will result in reduced emissions from energy production.[11] The extrinsic motivation for consuming the good is a function of the *private attributes* of the good, denoted by the vector Y, and the consumer's preferences over these attributes, denoted by the vector V_Y. The intrinsic motivation for consuming the good is a function of the *public attributes* of the good, denoted by the vector Z, and the consumer's preferences over these attributes, denoted by the vector V_Z. The price of the good is denoted by p. Thus, the direct benefit of consuming the good can be represented by:

$$V_Z \cdot Z + V_Y \cdot Y - p$$

For simplicity, we assume that the only public attribute is reduced emissions from reduced energy production. Thus, the public attribute vector reduces to a scalar and the direct benefit can be rewritten as:

$$v_z \cdot z + V_Y \cdot Y - p$$

The indirect benefit from consumption of the good is provided by the possibility of a "reputational payoff," if the consumer believes that the choice of one variety over another would either affect her reputation with others or her own self-image. In this way, our consumption choices can be thought of as a way to define ourselves to either ourselves or others. Following Bénabou and Tirole (2006), we assume that the reputational effect depends linearly on posterior expectations of the consumer's preferences over the good's public and private attributes.[12] This indirect benefit is specified as:

[11] Note that the framing of this choice task abstracts from the question of contributing to the public good by reducing consumption altogether. Thus, we limit ourselves to the situation in which the consumer is going to purchase a particular good, the only question is which variety.

[12] These expectations could be your own or those of others who are observing your purchase decisions, from the salesperson or clerk in the store to friends or family members. This latter notion could either imply that your

$$R(z,Y) \equiv x\left[\gamma_z E(v_z|z,Y) - \gamma_Y E(V_Y|z,Y)\right]$$

where x (> 0) measures the visibility or salience of the choice and γ_a, $\gamma_y \geq 0$. The nonnegative signs on γ_z and γ_Y reflect the idea that people would like to either appear or consider themselves to be both "*prosocial* (public-spirited) and *disinterested* (not greedy)." Thus, the individual faces the problem of maximizing the direct and indirect benefits over the choice of the *ith* variety or:

$$\max v_z \cdot z_i + v_Y \cdot Y_i - p_i + x\left[\gamma_z E(v_z|z_i,Y_i) - \gamma_Y E(v_Y|z_i,Y_i)\right]$$

We assert that the introduction of an environmental labeling program to this choice can have some combination of three different effects:

- By providing a tangible symbol of the social implications of the choice, the label increases the visibility or salience of the choice, thereby increasing reputational effects of the choice by increasing the value of x. The effect on x would likely vary depending upon the nature of the program, e.g., visibility of the label, trustworthiness of the sponsor, etc.;
- By providing information on the product's environmental attribute(s), the label is likely to lead consumers to update their expected value for z. It is unlikely that consumers will ever know with certainty the extent to which their choice of one variety over another contributes to the social good, but it seems quite likely that a label will alter their beliefs about this contribution[13]; and

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preferences are imperfectly revealed to you through your purchase decisions or, following Bénabou and Tirole (2006), that these preferences become inaccessible to you after some time, while your purchase decisions do not. The former would seem to be more in keeping with the approach taken by psychologists, who "would generally view people as unable to discern precisely their own motives even at the time they act" (Bénabou and Tirole 2006, p. 1657).

[13] Some caution is perhaps warranted here as the extent of the contribution may not be all that important given that, for many public goods, any single individual's contribution is unlikely to have more than an infinitesimal impact. For example, see Bénabou and Tirole, 2006, pp. 1657-8, for a decomposition of the intrinsic value to the actor of the actor's contribution to the public good into a concern for the level of the public good and a "joy of giving". Where any single individual's contribution to the public good is miniscule, the actor's motivation is limited to the "joy of giving". Whether the amount of joy is likely to be directly related to the amount of the gift is unclear.

- If the label has a private dimension (e.g., cost savings associated with reduced energy consumption), then the label is also likely to lead to an updating of consumer beliefs over the value of some element in the vector of private attributes Y.[14]

Thus, a labeling program with purely public benefits, such as the Green Power Partners program, would increase the visibility or salience of the choice and would likely alter consumer beliefs over the extent of the public benefits provided, but would not likely alter consumer beliefs over the private benefits provided by the different varieties. On the other hand, a labeling program with both public and private benefits, such as the ENERGY STAR program, would likely trigger all three effects. Finally, a more *symbolically neutral* program, such as the EnergyGuide label, would likely alter consumer beliefs over both public and private attributes, but would be unlikely to have as much of an effect on the salience of the choice. In fact, by exclusively focusing on cost and energy savings, the effect of the EnergyGuide label on many consumers might be limited to altering their beliefs over the value of the private attribute. Finally, to the extent that the introduction of a labeling program changes the values of z or y, it would also alter the reputational effects of the choice by altering the expected values of v_y and v_z.

For the single consumer in this model, MCO can be said to occur when the presence of a private benefit effectively "clouds" the signal sent by the consumer's decision to purchase the environmentally superior variety as it is no longer clear whether the consumer was motivated by pursuit of the public good or their own self-interest. Thus, the presence of the private reward increases the expected value of v_y and/or decreases the expected value of v_z. If this negative reputational effect is greater than the increase in utility associated with the private benefit, then the individual becomes more likely to consume an unlabeled variety. Which variety the

[14] Note that this can lead to an alternative explanation for a labeling program with a small private benefit having less of an effect than one with only a public benefit, namely that the labeling program effectively reduced consumer beliefs over the extent of the private benefit.

individual consumes will also depend upon other possible differences between the varieties, such as price and other private benefits.

To empirically test for the presence of MCO, we effectively need to compare two different labeling programs – one with both a public and a private benefit (such as emissions reductions and cost savings associated with energy efficiency) and one with only a public benefit.(such as emissions reductions associated with green power). If there is little or no difference between the public benefits of the programs, then MCO can be said to occur if the consumer would prefer an unlabeled variety when confronted with the labeling program with both a public and a private benefit but would prefer a labeled variety when confronted with the public-benefit-only labeling program.

Methods and Procedures

The Choice Experiment

Data on consumer responses to environmental labels will be collected through a survey containing a hypothetical market experiment referred to as *conjoint analysis* or *contingent choice* (CA).[15] This technique has been widely used by market researchers in the evaluation of new products and markets and is increasingly being employed by environmental economists. CA techniques are based on the premise that commodities can be viewed as bundles of various attributes, an idea dating back at least to Lancaster (1966). In CA studies, respondents are asked to rank or rate a series of these bundles in which some or all of the values or levels of the different attributes are allowed to vary. From these rankings or ratings, marginal rates of substitution between the different attributes can be estimated. Thus, by including price and

[15] Bartels, Fiebig and McCabe (2004) consider the benefits of using stated preference methods to analyze consumer response to an environmental label.

environmental performance as attributes, willingness-to-pay measures for changes in environmental performance may be derived.

CA, as a generic label, actually encompasses a number of specific "stated choice" methodologies (Freeman, 2003), that are differentiated on the basis of the choice task posed to the respondent. In *contingent choice* CA, respondents are asked to choose their most preferred product, or more generally, bundle of attributes, from two or more choices with differing attribute levels. [16] Some contingent choice studies force respondents to choose one of the alternatives and some allow respondents to reject all. *Contingent ranking* asks respondents to rank a set of hypothetical alternatives from "most preferred" to "least preferred." In a c*ontingent rating* exercise, respondents are asked to rate a set of hypothetical alternatives on a numerical scale. The difference between ranking and rating is that the latter asks respondents to supply information about how much they prefer one bundle to another while the former does not. Finally, in *graded pair* or *pairwise rating* surveys, respondents are shown two different alternatives and are asked to indicate the extent of their preference for one of the products over the other on a Likert scale. The exercise is then repeated a number of times with different hypothetical alternatives.

This project will employ contingent choice CA as it most closely replicates the purchase decision faced by actual consumers and, thus, allows us to construct an instrument that has the look and feel of a product design exercise and not an environmental-information-gathering exercise. It is hoped that this context will blunt some of the problems associated with the

[16] Dichotomous choice contingent valuation is essentially a special case of dichotomous choice CA, where the study is limited to two alternatives, one of which is the status quo, and only two variables - price and the environmental quality variable - are allowed to vary. Relaxing these restrictions allows CA to emphasize tradeoffs among hypothetical alternatives over the purchase of an environmental amenity and it has been argued that this change in emphasis deflects emotive responses and, as a result, is less likely to generate protest or symbolic responses.

hypothetical nature of stated choice methods (Freeman, 2003). Figure 3 provides an illustration of how a contingent choice question for different varieties of a refrigerator might look.

Figure 3. Example of a Contingent Choice Question for a Refrigerator.

	If you were shopping for a side-by-side refrigerator/freezer for your home and these were your only options, which would you choose?		
Brand **Size** **Icemaker** **Warranty** **Energy Usage** **Price**	❍ Frigidaire 21.7 cubic feet Icemaker in freezer 2 year warranty ENERGY STAR $1199	❍ GE 25.3 cubic feet Icemaker in freezer 2 year warranty Meets Federal Requirements $1479	❍ Amana 23.9 cubic feet In-door dispenser 1 year warranty ENERGY STAR $1349

Note: The order of these attributes will be randomized across versions of the survey instrument.

The Rest of the Survey

Following the CA exercise, survey respondents will be asked a series of debriefing questions to probe deeper into the basis for the respondent's reaction to the labels, including familiarity with the labeling program, importance of the public or private benefit, extent to which respondent considered nature or timing of emissions reductions, anticipated life expectancy of the appliance, etc. Following these debriefing questions, respondents will be presented with a series of attitudinal questions designed to probe the extent to which respondents are concerned about the environment (Antil, 1984; Granzin and Olsen, 1991; Mainiere and Barnett, 1997; Minton and Rose, 1997; Roberts, 1996; Roberts and Bacon, 1997; Schlegelmilch and Bohen, 1996; Schwepker and Cornwell, 1991; Shetzer, *et al*, 1991). These questions will be patterned upon the New Ecological Paradigm Scale (Clark, Kotchen, and Moore, 2003; Dunlap, Van Liere, Mertig, and Jones, 2000), with respondents being asked to indicate the extent to which they agree with each a series of statements, similar to those shown in Table 2, on a Likert scale (strongly agree, mostly agree, undecided, mostly disagree, strongly disagree). Respondents will also be

asked to indicate the extent of their agreement with a set of statements related to altruism, similar to those shown in Table 3.

Table 2. New Ecological Paradigm Statements.

Statement
(1) The balance of nature is very delicate and easily upset.
(2) Plants and animals have as much right as humans to exist.
(3) Humans will eventually learn enough about how nature works to be able to control it.
(4) The so-called ‘‘ecological crisis’’ facing humankind has been greatly exaggerated.
(5) If things continue on their present course, we will soon experience a major ecological catastrophe.
(6) Humans were meant to rule over the rest of nature.
(7) The earth is like a spaceship with very limited room and resources.
(8) Human ingenuity will insure that we do not make the earth unlivable.
(9) We are approaching the limit of the number of people the earth can support.
(10) The balance of nature is strong enough to cope with the impacts of modern industrial nations.

Table 3. Example Altruism Statements.

Statement
(1) I worry about conserving energy only when it helps to lower my utility bills.
(2) Contributions to community organizations can greatly improve the lives of others.
(3) The individual alone is responsible for his or her satisfaction in life.
(4) It is my duty to help other people when they are unable to help themselves.
(5) Many of society’s problems result from selfish behavior.
(6) Households like mine should not be blamed for environmental problems caused by energy production and use.
(7) My responsibility is to provide only for my family and myself.
(8) Use of renewable energy is the best way to combat global warming.

Using a similar process, respondents will be asked to indicate the extent to which they believe that their consumption decisions can affect the environment (Allen and Dillon, 1979; Berger and Corbin, 1992; Ellen, *et al*, 1991; Obermiller, 1995; Roberts, 1996; Scholder and Cobb-Walgreen, 1991) and how likely they are to participate in specific pro-environmental actions (e.g., recycling) in the future. Exactly which and how many of these statements are included in the final survey version will depend upon a number of factors, not the least of which is the overall length of the instrument.

Finally, respondents will be asked a series of demographic questions. These questions will include household income, age, gender, education level, employment status, type of residence (single family detached house, condominium, apartment, mobile home or other), residence ownership, number in household, number of minors in household, and zip code. A copy of the survey instrument will be available upon request from the authors.

Survey Implementation

The survey will be conducted by computer over the internet. Telephone and computer surveys have certain advantages over the pencil-and-paper variety, as they allow the researcher to retain more control over the administration of the survey, ensure that all questions are answered in the order in which they are given, and provide researchers with flexibility in designing the set of choice tasks faced by respondents (Louvieve, *et al*, 2000). This last advantage is particularly important in CA exercises as it allows the set of choice tasks faced by each respondent to be interactively determined as the respondent progresses through the set, maximizing the amount of information gleaned from a given number of choice tasks. Telephone surveys are not particularly well suited to CA exercises due to the nature of the choice task. Computer surveys have the added advantage of improving accuracy by eliminating the need for manual or scanned data entry. Finally, an important advantage of online surveys is that they can provide relatively inexpensive access to a large sample, which cannot be said for an in-person survey.

For this survey, respondents will be located through a pool maintained by an online marketing firm, contacted by e-mail, and attracted with an offer of a cash incentive or prize drawing conducted by the online marketing firm. While efforts will be made to ensure that the

sample is as representative of the general population as is possible, the survey method used will inevitably result in a sampling bias in favor of those people who have access to computers and who have, at one time or other, volunteered to participate in an online survey. While this bias could have important implications for the extrapolation of any willingness-to-pay numbers generated by the survey, there is no reason to think that it would be correlated with individual behavior in response to intrinsic and extrinsic motivation. That said, while it will be possible to compare the sample demographic characteristics to regional or national averages to note any differences and possibly weight the sample to more closely reflect the general population, it will be difficult to determine whether the sample is drawn from a population who is more or less likely to consider an environmental label in their purchase decisions.

Product Selection

We have selected the side-by-side refrigerator/freezer ("refrigerator") to be the focus of our analysis. This selection is based on a number of factors all of which should help to provide a solid base from which to launch this analysis. First, refrigerators are significant consumers of energy relative to other home appliances. Second, the refrigerator is an appliance with which virtually everyone will have a high degree of familiarity. This familiarity should help to ensure that respondents can understand and appreciate differences in the attributes used to distinguish different refrigerator varieties. Third, the refrigerator can be adequately described with a fairly limited number of attributes. Also, the differences in aesthetic or visual qualities that would be difficult to capture in a survey are not as important as they are for many other home appliances, such as the picture quality for a television set or computer monitor. Fourth, consumers strongly associate the ENERGY STAR label with refrigerators, as prior research indicates that among those

who recognized the ENERGY STAR label, seventy-four percent of households had seen the label on refrigerators (USEPA, 2007b). Similarly, the ENERGY STAR label appears to have made considerable inroads into the refrigerator market, achieving a 32.9% share of the refrigerator market in 2005 (Sanchez, Webber, Brown and Homan, 2007). Finally, the ENERGY STAR program provides detailed information on refrigerators and, as noted previously, a large number of studies have analyzed consumer response to the provision of information on the energy consumption profiles of refrigerators.[17]

Attribute Identification and Selection

The starting point for identifying, describing and selecting the attributes to describe and distinguish different refrigerator varieties is the information provided by the ENERGY STAR program, which is summarized in Table 4.

Table 4. Refrigerator Attribute Information Provided by ENERGY STAR Materials

Attribute	Description
Brand and Model	The brand and manufacturer model number identify a particular refrigerator. Model numbers often contain wildcard characters, such as *, #, and X, that are placeholders for non-energy attributes, such as color.
Volume (ft3)	The total interior volume of the refrigerator and freezer compartments.
Adjusted Volume (ft3)	The sum of the fresh food compartment volume and the product of an adjustment factor and the net freezer compartment volume used to determine the federal energy conservation standards for refrigerators and freezers.
Configuration	The configuration of the refrigerator or freezer in one of the following types: a. TF: Top Freezer b. BF: Bottom Freezer c. SS: Side-by-Side d. SD: Refrigerator only - single door

[17] Other products considered included all ENERGY STAR qualified products and also water heaters and clothes dryers. This list was narrowed to four candidate products (refrigerator/freezers, water heaters, compact fluorescent lights, and washing machines) and a detailed list of pros and cons developed for each product. On the basis of these lists, it was determined that side-by-side refrigerator/freezers were the best choice.

	e. SR: Refrigerator/Freezer - single door f. UF: Upright Freezer g. CF: Chest Freezer
Defrost Type	Refers to the defrost function. Automatic, manual and partial defrost are the standard types.
Compact	Refers to refrigerators, refrigerator-freezers, and freezers with a total volume of less than 7.75 cubic feet and 36 inches or less in height.
Ice	Whether or not the model has the through-the-door ice feature.
KWH/Year	The estimated annual energy use in kilowatt hours of the refrigerator or freezer under typical conditions.
NAECA Std. (Federal Standard)	The federal standard for energy consumption in kWh/year required of a refrigerator or freezer of that particular volume and configuration. The standard varies depending on the size and configuration of the refrigerator.
% Less Energy	How much less energy the model uses compared to the 2001 NAECA (federal) standard. The ENERGY STAR qualification levels depend on the size and type of refrigerator or freezer.

The literature also provides considerable guidance on refrigerator attributes. For example, Dyer and Maronick (1988) surveyed refrigerator purchasers to determine which attributes or factors purchasers considered important factors in their purchase decisions (Table 5) and how important these attributes were to their selection of a particular refrigerator variety (Table 6).

Table 5. Percentage of Refrigerator Purchasers' Mentioning an Attribute as Important to Purchase Decision

Attribute	Percentage (N=700)
Size	60.1
Color, Appearance	28.4
Price	22.7
Doors-number/position	28.3
Energy efficiency (net)	25.7
Separate meat compartment	13.3
Separate temperature controls	5.5
Brand name	10.7
It was on sale	4.0
Self-Frost/Frost-Free	29.6
Ice-maker/Water dispenser	16.2

Source: Dyer and Maronick (1988)

Table 6. Percentage of Refrigerator Purchasers Ranking Attribute as Extremely Important to Purchase Decision

Attribute	Percentage (N=700)
Size	71.0
Price	58.5
Guarantee/Warranty	60.5
Appearance/Color/Looks	47.7
Yearly amount of energy used	41.8
Yearly energy cost	39.9
Brand name	29.3

Source: Dyer and Maronick (1988)

In addition, Greening, Sanstad, and McMahon (1997) included food compartment volume, freezer compartment volume, annual energy usage, type of outlet purchased from, wire or glass shelves, factory installed ice maker, configuration of refrigerator (for example side-by-side), and region of purchase as characteristics in a hedonic model of refrigerator prices. Shepler (2001) examined the effect of refrigerator attributes on prices and included brand, bottom freezer, sound insulation, water filtration, humidity controls, three drawers, energy saver switch, color, ice maker (none, icemaker ready, factory installed, or through the door ice and water service), type of outlet where purchased, region and city size of purchase location. The projected range of prices from this study was $926 to $2,408 in 1999$. Adjusting these prices by the All Urban Consumers CPI for 2007, the range would be $1,147 to $2,982. USDOE (2005) estimates that the current ENERGY STAR rating adds between $47.17 and $88.12 to the price for a side by side refrigerator with through the door ice service (in 2005 $).

To supplement these results, we performed our own analysis of the 20 top selling refrigerator models at four different online appliance retailers (AJ Madison, Best Buy, Home Depot and Sears). The resulting product attributes and their respective levels are summarized in Tables 7 and 8.

Table 7. Summary of Categorical Product Attributes from Analysis of Top Selling Refrigerators at Select Retailers.

Attribute	Level	Frequency (%)
Brand	Frigidaire	7.4%
	Galaxy	2.5%
	GE	27.2%
	Hotpoint	8.6%
	Inglis	1.2%
	Kenmore	18.5%
	LG	9.9%
	Maytag	14.8%
	Samsung	1.2%
	Whirlpool	8.6%
Retailer	AJ Madison	24.7%
	Best Buy	25.9%
	Home Depot	24.7%
	Sears	24.7%
Noise Control	Yes	61.7%
	No	38.3%
Humidity Control	Yes	80.2%
	No	19.8%
Ice/Water through the Door	Yes	100.0%
	No	0.0%
Finish	Bisque	4.9%
	Black	21.0%
	Satina	2.5%
	Silver	21.0%
	Stainless	24.7%
	White	25.9%
ENERGY STAR	Yes	70.4%
	No	29.6%
Three Drawers	Yes	50.6%
	No	49.4%
Glass Shelving	Yes	98.8%
	No	1.2%
Water Filtration System	Yes	96.3%
	No	3.7%

Table 8. Summary of Numerical Product Attributes from Analysis of Top Selling Refrigerators at Select Retailers.

Attribute	Mean	Median	Minimum	Maximum
Price	$1,067	$1,000	$665	$2070
Cubic Feet	24.8	25.1	21.7	26.0

Further, to help define a realistic set of attribute/price combinations, we used this data to perform a simple linear regression of the attribute levels on price. The results of this regression are summarized in Table 9. Note that for the brand dummy variables, the brands Galaxy, Inglis and Samsung represent the base case, while for the retailer dummy variables, Sears is the base case.

Table 9. Results of Regression of Attribute Levels on Price.

Variables	Coefficients		t	P-value
	Beta	Standard Error		
(Constant)	460.327	429.012	1.073	.287
Whirlpool	187.051	230.942	.810	.421
Frigidaire	-61.478	258.439	-.238	.813
GE	-215.283	224.498	-.959	.341
Hotpoint	-134.871	282.040	-.478	.634
Kenmore	-60.861	242.972	-.250	.803
LG	-62.139	258.460	-.240	.811
Maytag	-235.973	224.607	-1.051	.297
AJ Madison	-147.288	122.819	-1.199	.235
Best Buy	-179.449	118.116	-1.519	.134
Home Depot	-194.160	120.731	-1.608	.113
Stainless Finish	273.049	60.228	4.534	.000
Cubic Feet	13.689	18.517	.739	.462
Noise control	227.560	309.937	.734	.466
Humidity Control	-44.490	182.661	-.244	.808
ENERGY STAR	192.458	93.034	2.069	.043
3 Drawers	120.118	75.726	1.586	.118
Water Filtration System	146.560	158.400	.925	.358

The number of product attributes for this study must be limited to ensure a manageable set of choice tasks. Thus, several refrigerator attributes will be held constant across all of the varieties. The refrigerator configuration will be side-by-side, because nearly 56% of the ENERGY STAR refrigerator models are side-by-side. All side-by-side ENERGY STAR models are automatic defrost and virtually all have ice makers. Thus, all of the varieties in the survey will be automatic defrost and will have an ice maker. Further, the brand will be limited to one of the four mid-range brands - Frigidaire, General Electric, Kenmore, or Whirlpool - that together comprise over 55% of the U.S. market (USEPA, 2007d). The non-environmental product attributes which we

will consider including in the choice tasks (i.e., which will be allowed to vary across the different varieties) and our working supposition of their values are as follows:

- Volume (22.5 cu ft , 24.5 cu ft, and 26.5 cu ft);
- Finish (Stainless Steel, Color (white, almond, black, other));
- Shelving (glass, wire, or plastic);
- Noise control (yes or no);
- Water filtration (yes or no);
- Ice and water service through the door (yes or no);
- Humidity-controlled crisper drawer (yes or no);
- Temperature controlled deli-drawer (yes or no);
- Length of limited parts and labor warranty (1 or 2 years); and
- Price ($800, $1,100, $1,400, $1,700, $2,000, $2,300)

Environmental Labels

There will be four different survey versions with the only difference between the four being the environmental label included in the conjoint analysis exercise. Two of the versions will utilize an ENERGY STAR label. Descriptions of the labels will posit the same energy savings and emissions reductions but will differ in terms of the cost savings associated with the energy savings, which in turn, will be based upon different assumed electricity prices. One will be based on some historical low price (e.g., the 10 year low), while the other will be based on a high price corresponding to future electricity price projections. The third survey version will use a Green Power Partnership label, where the emissions reductions will approximate the annual emissions reductions for the ENERGY STAR label. The fourth survey version will use a hypothetical Energy Saving Manufacturer label that will ostensibly be awarded to products that have been manufactured with energy saving manufacturing processes. Once again, the total emissions reductions will approximate the annual savings from the ENERGY STAR program.[18]

[18] The Energy Saving Manufacturer label is included because the public benefits correspond closely to those of the ES - emissions reduction from reduced energy consumption. The Green Power Partners label is included, in part, because it is not fictitious (although it will have to be manipulated to be made applicable to an individual product)

We have chosen to use seal-of-approval type labels for this research because they are the most popular form of environmental label (USEPA, 1998) and because it is well suited to the methodology and approach to be employed in this project. The problem with other label types such as the "report card" (for a description of the report card and other label types, see USEPA, 1993) is that the neutral manner in which they present their environmental information may not provide a basis for intrinsic motivation and, more practically, because they make the coupling of a private and public benefit awkward. The US label that provides the best example of this coupling is the ENERGY STAR (ES).

Respondents will be provided information on the labels via an information or education screen, similar to that shown in Figure 4. The screen will provide respondents a basic idea of the labeling program, with an option to acquire more detailed information or proceed with the survey. The additional information provided will include more details on the label sponsor, the criteria for awarding the label and the process by which the label is awarded. Respondent choice of acquiring more information or proceeding will be recorded and incorporated into the analysis. Similar information screens will appear for the non-environmental attributes.

Figure 4. Example of ENERGY STAR Information Screen.

Another factor that you may consider is whether or not the refrigerator has been awarded an ENERGY STAR® label. All refrigerators sold in the US are required to meet federal guidelines limiting their energy consumption. To be awarded the ENERGY STAR label, the refrigerator must consume at least 20% less energy than the federal guidelines. As a result, an ENERGY STAR refrigerator will, on average, reduce a household's electricity bill by $14 per year and reduce the emission of carbon dioxide associated with energy production by about 195 pounds per year. Carbon dioxide is a greenhouse gas that contributes to global climate change.
Would you like more information on this attribute or are you willing to proceed with the survey? ❍ **Ready to proceed** ❍ **Would like more information**

and therefore of more interest for public policy reasons, but also to evaluate whether the nature of the emissions reductions is relevant to respondents.

The ENERGY STAR information screen will provide respondents with an estimate of the electricity use reduction, the resulting reduction in electricity costs, and the associated reduction in CO_2 emissions from the purchase of an ENERGY STAR refrigerator as opposed to a refrigerator that simply meets minimum federal standards. These estimates are provided in Table 10. Department of Energy Information Administration (US DOE/EIA, 2006) estimates that average US CO_2 emissions per kWh of net electricity generation are 1.37 pounds, calculated as 2005 emissions of 2.51 billion metric tons (about 5,540 billion pounds) divided by 4,055 billion kWh net generation of electricity.

Table 10. Projected Energy and Emissions Savings with ENERGY STAR Refrigerator

Refrigerator Volume (cubic feet)	22.5	24.5	26.5
Projected Adjusted Volume (cubic feet)[a]	27.47	30.44	32.73
Maximum under Federal Requirements (annual kWh)[b]	683.45	713.4	736.57
Maximum under ENERGY STAR (annual kWh)[c]	546.76	570.72	589.25
Energy Savings with ENERGY STAR (annual kWh)	136.69	142.68	147.31
Energy Cost Savings with ENERGY STAR (annual $)[d]	$14.23	$14.85	$15.34
Reductions in CO_2 emissions with ENERGY STAR (annual pounds)	187.27	195.47	201.81

[a] The adjusted volume is based upon the freezer compartment to fresh compartment volume of similarly sized ENERGY STAR side-by-side models. The formula for the adjusted volume (AV) is AV= V*(1-f)+V*f*1.63, where V is volume and f is the proportion of volume taken by the freezer.
[b] The formula to calculate the federal requirement (FR) is FR ≤ 10.10*AV+406.0 kWh (USDOE/EERE, 2005).
[c] The new (2008) ENERGY STAR requirement of 20% reduction is used.
[d] The energy cost savings are calculated at 10.41 cents per kWh (EIA national average residential energy price for electricity year-to-date through June 2007 (USDOE/EIA, 2006).

Examples of initial efforts to construct information screens for the other two programs are shown in Figures 5 and 6.

Figure 5. Example of Green Power Partner Information Screen.

Another factor that you may consider is whether or not the refrigerator has been manufactured by a company that participates in the Green Power Partner program. To participate in the Green Power Partner program, a specified percentage of the annual electricity requirements of the manufacturer must come from renewable sources such as solar, wind, geothermal, biogas, biomass, or low-impact small hydroelectric sources. It is estimated that by meeting the requirements of the program, a refrigerator manufacturer will reduce the emission of carbon dioxide associated with energy production by about 195 pounds for every refrigerator produced.

Carbon dioxide is a greenhouse gas that contributes to global climate change.

Would you like more information on this attribute or are you willing to proceed with the survey?

❍ **Ready to proceed**

❍ **Would like more information**

Figure 6. Example of Energy Saving Manufacturer Information Screen.

Another factor that you may consider is whether or not the refrigerator has been manufactured by a company that participates in the Energy Savers program. To participate in the Energy Savers program, the manufacturer must reduce energy consumption by installing energy-saving technologies or adopting energy-saving practices. It is estimated that by meeting the requirements of the program, a refrigerator manufacturer will reduce the emission of carbon dioxide associated with energy production by about 195 pounds for every refrigerator produced. Carbon dioxide is a greenhouse gas that contributes to global climate change.

Would you like more information on this attribute or are you willing to proceed with the survey?

❍ **Ready to proceed**

❍ **Would like more information**

Focus Group Analyses

Three different rounds of focus group meetings will be conducted to evaluate the product and attribute selections, the descriptions of the environmental labels, and the choice experiments and actual survey instrument. The first round will be used to evaluate and guide our decisions on product choice and attribute specification. As for product selection, we will focus on a refrigerator and the various attributes that can be used to differentiate different varieties of refrigerators to the focus groups. If, after the analysis, we determine that refrigerators are not a viable option, we will repeat the process for another appliance. Thus, the final product and attribute selection will not be made until after we have vetted the product and attributes with a focus group.

Since the choice task can not include all possible attributes, a primary goal of the focus group work will be to determine which attributes to include in the choice tasks, which to hold constant across all versions and which can be reasonably ignored. Our expectation is that any

attribute that consumers would "expect" to see in connection with a description of different varieties of the product will be either included in the choice task or included in a description of the product the respondents are being asked to evaluate (i.e, held constant across the choice tasks). An important part of this analysis will be evaluating respondent understanding and response to the different attributes. Thus, this analysis will also be used to ensure that attribute descriptions will be clearly understood by survey respondents.

The second round of the focus group meetings will concentrate on the environmental labeling attributes to be included in the analysis. This attribute warrants its own focus group acitivy because it is central to the project and because of the complex issues surrounding consumer understanding and perception of the various labels. The primary intent here will be to insure that the label descriptions are as clear and cogent as is possible. The effort will likely proceed in two stages, with the first involving open-ended sessions designed to better understand how people think about the underlying issues of energy savings and associated cost savings and emissions reductions. The second session will be used to evaluate specific descriptions of the labels and their relevance to these issues.

The third round of the focus group meetings will be used to evaluate the full survey instrument, emphasizing the ability of respondents to navigate the choice tasks. The intent will be to ensure that all aspects of the survey are easily and correctly understood, and that there are no technical, technological or other problems associated with respondent completion of the survey. This approach will consist of question-and-answer sessions with individuals who have completed the choice tasks and an online pre-test of the survey instrument itself.

A Priori Hypotheses

The test of the MCO hypothesis will be that WTP implied by the choices made for the public-benefit-only labels (GPP and ESM) is greater than that for the low private benefit ES label (ES_L), but less than that for the high private benefit ES (ES_H) label [*i.e.*, $WTP(ES_H) > WTP(GPP, ESM) > WTP(ES_L)$]. Including both the GPP and the ESM labels not only makes for a more robust test of MCO, but it also would allow us to test for differences in consumer perceptions in how the emissions reductions were generated (renewable energy or energy conservation).

One concern about this approach is that there is a difference in the flow of emissions reductions over time between the ES program - where energy savings and hence reductions would presumably occur over the life of the product - and the GPP and ESM programs, where the energy savings and reduction would ostensibly occur only during the construction of the product. Since individuals are likely to discount future emissions reductions at different rates (between zero and infinity) and have different expectations as to the life of the appliance, it would be extremely difficult to equate the "one-time" reductions from the GPP and ESM programs with the flow of reductions associated with the ES label. However, we do not think that this is as problematic as it might first appear. First, we believe that the actual amounts of emissions reductions will make little or no difference to consumers as they have little context by which to judge these reductions and because their production choice implies an infinitesimal contribution to the public good, i.e., environmental quality.[19] Second, it is not all that clear that the contribution to the public good through the purchase of a GPP or ESM product should be considered a "one-time" reduction. After all, the appliance has already been constructed when it

[19] See earlier discussion of why the "joy of giving" may be the important thing. Alternatively, thinking back to our discussions of the underlying economic model (i.e., Bénabou and Tirole (2005)), the important thing to the consumer is to somehow define herself as "environmentally responsible" and choosing the environmentally superior option may accomplish this task regardless of how superior it in fact is.

is purchased. By purchasing a labeled appliance (be that label ES, GPP, or ESM), the consumer is not only having some (perhaps infinitesimally small) direct impact, but is also in a sense "voting" for emissions reductions with some not completely unreasonable belief that her vote may have some influence on: manufacturer decisions over whether to produce or market more or less labeled varieties; retailer decisions over whether to stock or market more or less labeled varieties; the decisions of other consumers, or policymakers. Thus, it is plausible that the consumer may be motivated not only by the direct impact but also by an expected value of their vote that is equal to the probability that it will influence the actions of another multiplied by the effect of such actions on emissions. Further, the latter may well outweigh the former. To the extent that the latter does serve as a motivator, then the value of the vote (in terms of emissions reductions) will accrue in the future, which means that the reductions associated with the GPP and ESM labels are not simple one-time events.

For the purposes of testing the MCO hypothesis, what seems to be important is that the present value of the discounted emissions savings from the ES program are at least as great as the savings from the GPP and ESM programs. If this can assumed to be true, then it can be argued that $WTP(ES_H) > WTP(GPP, ESM) > WTP(ES_L)$ implies MCO regardless of how respondents to the ES label discount future emissions reductions. If respondents did not believe this to be true, then it could be argued that the higher willingness to pay for GPP and ESM labeled varieties were a function of the higher emissions reductions perceived to be associated with these labels.

One key to this test is that the increase in extrinsic motivation associated with higher level of the private benefit compensates for any loss in intrinsic motivation associated with the presence of the private benefit. Otherwise, we will not be able to distinguish between MCO and

stronger preferences for the nature of the contribution to the public good associated with the GPP or ESM programs. Thus, the cost savings associated with the ES_H program will need to be set at a fairly high level.

An additional point is that we are largely ignoring the EnergyGuide label. For the ES versions of the survey, the energy efficiency of the non-labeled varieties of the appliance will be constrained to meeting the minimum federal requirements. Thus, by describing the energy and cost savings of the ES variety over the variety that only meets the minimum federal requirements, we will essentially be providing the same information that a comparison of the EnergyGuide labels for the two varieties would provide. For the GPP and ESM versions of the survey, the (universal) description of the appliance being evaluated will contain either information on energy cost and consumption or will simply state that the appliance meets the federal minimum requirements. Thus, in these versions, there will be no energy consumption attribute. This solution unfortunately abstracts from the rich environment surrounding appliance consumption, but is necessary to create the distinction between a labeling program with purely public attributes and one with public and private attributes.

The structure of the surveys will also enable us to investigate a number of other issues and test a number of other hypotheses. Some of these other issues are:

- The salience of the different environmental labels relative to price and non-environmental attributes;
- Relationship between consumer response to the environmental label and the attitudinal and demographic variables;
- Effect of the two different levels of private incentive with the ENERGY STAR label (ES_H and ES_L);

- Whether respondents receiving the survey versions with the public-reward-only label (GPP and ESM), and thus those who have not had their intrinsic motivation reduced, will be more likely than those receiving the survey versions with the public/private label (ES_H and ES_L), to state a willingness to engage in pro-environmental actions in the future;
- Whether there is an interaction effect between the environmental labels and price of the product, with the public-reward-only labels (ESM and GPP) showing less sensitivity to changes in price than the public-private labels (ES_H and ES_L);
- Discount rate necessary to justify willingness to pay for product varieties with the ENERGY STAR label; and
- Whether consumers exhibit differences in preferences over the manner in which the emissions reductions are achieved, as indicated by differences in willingness-to-pay between for product varieties with the GPP and ESM labels.

Econometric Analysis

The econometric analysis will consist of three parts. First, utility functions will be estimated based on responses to the CA questions. Second, willingness to pay measures for the environmental attributes will be calculated. Third, comparisons of these willingness to pay measures and/or characteristics of the utility functions across instrument formulations and respondent characteristics will be carried out in order to test the hypotheses proposed above.

The estimation of the utility functions typically involves likelihood maximization with a likelihood function constructed using response probabilities derived from an underlying economic model of random utility maximization (RUM), based on the approach originally

outlined by McFadden (1974). In this general formulation, a respondent's utility associated with the *ith* alternative, u_i , consists of a deterministic component, v_i , and a stochastic component, ε_i:

$$u_i = v_i + \varepsilon_i \qquad i = 1,...,N \tag{1}$$

The deterministic component will be some function of attributes of the alternative (denoted X_i) and of the individual (denoted Z)

$$v_i = f(X_i , Z; \beta) \tag{2}$$

where β is a vector of parameters to be estimated. The stochastic component reflects unobserved attributes of either the individual or the alternative and/or random variation in preferences among individuals. The ε_i's are assumed to have a zero mean, and are conventionally taken to be independently and identically distributed (IID) and to be homoscedastic, with a constant variance. Because of its tractability, the model usually employed is a multinominal logit (MNL) model in which the ε_i's are assumed to be IID extreme value with a common scale parameter μ; in this case the probability of selecting the *ith* alternative in a CA experiment is given by

$$Prob(i\ chosen) = exp(\mu v_i) / \sum_j exp(\mu v_j). \tag{3}$$

In this framework, the parameters to be estimated are β and μ. With most formulations of (2), one of these parameters will not be identified; this is generally handled by normalizing $\mu = 1$. Given estimates of β (and μ), one can define compensating variation (WTP) or equivalent variation (WTA) welfare measures for items or for attributes of items featured in the CA experiments. Given the RUM formulation, WTP and WTA are random variables from the point of view of the researcher, with probability distributions induced by those of the ε_i's. For a point estimate, it would be natural to employ the mean or median of this distribution. Hanemann (1999) shows some theoretical properties of these welfare measures, and Herriges and Kling

(1999) examine their empirical properties based on a Monte Carlo markov chain simulator developed by McFadden (1995).

To analyze our survey data, we expect to employ more complex RUM models than the MNL model in (3), for three important reasons. First, the MNL model does not allow adequately for heterogeneity in preferences among respondents – the systematic heterogeneity is reflected in the set of variables included in Z, and all the residual heterogeneity must be captured in the ε_i's. Second, the MNL model implies an assumption of independence of irrelevant alternatives (IIA) that experience has shown is often violated. Third, the MNL model implies that, in evaluating alternatives, the individual exhibits variances of the ε_i's that are constant irrespective of the alternative and the preference elicitation task and setting – assumptions that experience has shown are also often violated. Therefore, richer models will be needed for our data analysis.

The key to obtaining a model that avoids these restrictions is to employ a different and more general stochastic specification of the ε_i's. There is now a substantial literature on how to do this, which is summarized by several of the contributors to a special issue of the *Journal of Econometrics* (Vol. 89, 1999), as well as in the recent textbook by Louviere, *et al* (2000). Most of these involve variants of the extreme value distribution, including the following: (1) Nested logit, based on the generalized extreme value distribution; this relaxes the IIA assumption, but it requires that the all of the ε_i's within any given cluster have the same variance. (2) Random effects heteroscedastic logit model (Bhat, 1995; Hensher, 1998), allows the ε_i's to be independently, but not identically, distributed as extreme value variates, each with a separate variance. This formulation has been used extensively for the purpose of combining choice data from different sources – e.g. from different surveys or different elicitation formats (Louviere, *et al*, 2000, Chap 8). (3) Covariance heterogeneity fixed effects model, in which the variances of

the ε_i's is explicitly parametrized as a function of covariates. This has been used by Swait and Adamowicz (1999) to model the effect of the complexity of the choice task (represented through some appropriate metric) on the variability of CA responses; it could similarly be used to capture effects such as learning or fatigue that might influence responses as the survey progresses; or respondent uncertainty, where the variance is a function of respondent characteristics (e.g. level of education) or characteristics of the specific choice (e.g., degree of similarity among the alternatives in the choice experiment). (4) Mixed logit, where a part of the ε_i vector is assumed to have an error-components structure that can induce both heteroscedasticity and correlation over alternatives (Brownstone and Train, 1999); McFadden and Train (1997) prove that *any* RUM model can be approximated arbitrarily closely by an appropriate mixed logit model. (5) Random parameter logit, where (a subset of) the coefficients β in (2) are taken to be random with some mean and some covariance matrix (Revelt and Train, 1998); while the motivation is different, this model may be formally indistinguishable from the mixed logit model. If the coefficient associated with an attribute of the individual (Z) is random, this allows for correlation of the random component across responses from the same respondent. (6) Models where ε_i consists of two components, one being extreme value and the other normal, yielding what Ben-Akiva and Bolduc (1996) call "probit with a logit kernel;" an example is a random parameters model where β is normally distributed (Allenby, *et al*, 1998). (7) Hierarchical Bayes models (Lenk *et al*, 1996), which employ a probit model with a logit kernel embedded in a Bayesian setting where the researcher has a prior distribution for β and uses the CA data to obtain an updated posterior distribution for β. (8) Latent class heteroscedastic MNL models where, instead of the random parameter formulation (5) with the parameters drawn from some continuous distribution, the parameters are assumed to have a discrete joint distribution with a discrete number (say S) of

support points – it is assumed that there are *S* types of consumers, each with its own parameter vector β_s; in addition to the S parameter vectors, one estimates a class inclusion probability π_s giving for each individual the probability that he is of type *s*. An early application of a latent class model in marketing is Swait (1994); a more recent application to CA is Peter Boxall's Ph.D dissertation (Boxall, 1999).

Of these alternatives, only nested logit yields a simple, closed-form expression for the choice probabilities in (3); the other approaches involve conditional choice probabilities integrated over the distribution of the random components which do not yield closed-form expressions and require some form of numerical integration instead. While numerical approximation was used previously, Monte Carlo simulation is now widely employed as the method of integration, and software to do this is available from David Hensher and Kenneth Train which can be adapted to deal with the various approaches associated with (2) through (6). The Bayesian approach in (7) requires more complex simulation of probability integrals, but this is available in a canned routine from Sawtooth Software. The latent class models (8) are implemented through standard maximization software. While we are prepared to investigate a variety of models if the data appear to require this, at this point we expect to focus most of our attention on random effects logit (2), the covariance heterogeneity fixed-effects model (3), mixed logit (4) and possibly latent class models (8).

Conclusion

This project will provide information relevant to both consumer labeling and information disclosure generally and will help in the design of these programs. It will produce evidence of a preliminary but helpful sort about:

- How labels that provide information that is predominantly, if not solely, of a public good nature are likely to fare relative to labels that combine the public reward with a private reward, especially those that provide what might be considered a "token" private reward;
- What consumer characteristics are likely to be associated with willingness to consider an environmental attribute in consumption decisions;
- How useful CA is for assessing labeling proposals; and
- How seriously to take the wealth of marketing surveys in which respondents appear responsive to environmental labels.

In broader terms, this research has important implications for the use of information disclosure, if not market mechanisms in general, in all areas of environmental regulation. Intrinsic motivation, on some level, is almost certain to be lurking in the basis for all environmental information disclosure programs because of the public good qualities of improvements in environmental performance. Thus, while information from the Toxics Release Inventory may prompt an investor to shy away from or gravitate toward a particular firm or industry because of what the information indicates about likely needs for future capital or equipment costs associated with emissions abatement, it is perhaps equally likely that the investor's concern for the future profitability of the firm or industry involves intrinsic motivation. Either the investor herself might hold preferences over a firm or industry's environmental profile, or the investor may be concerned about the likelihood that other consumers may now or in the future hold, and be willing to act upon, such preferences.

At an even broader level, economists have long argued for the adoption of market mechanisms as instruments of environmental regulation. However, the pace of adoption has been slowed by a number of different objections to these types of instruments. One of the most

commonly expressed, but least tested, objections concerns what might be called their amorality - i.e., that, by "legalizing pollution," these policies will engender "moral ambiguity" and ultimately increase the difficulty of the regulator's task. An expansive view of this research is as an attempt to use the distinction between intrinsic and extrinsic motivation to test this objection. After all, what are market mechanisms, but appeals to extrinsic motivation? And, what reasonable definition of moral ambiguity would not encompass a process by which intrinsic motivation to protect the environment is crowded out by extrinsic motivation to benefit oneself? Thus, MCO and, more generally, the distinction between intrinsic and extrinsic motivation provide the means to state this general objection to market mechanisms in an empirically testable form.

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